# XC-RP300
# VDSL Repeater
# Owner's Manual

**GDI COMMUNICATIONS LLC.**

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# GENERAL INFORMATION

Thank you for purchasing this GDI Communications LLC. product. The XC-RP300 repeater is an ideal way to extend a VDSL connection and add Ethernet access. No special wiring or networking knowledge required. The XC-RP300 allows you to connect LANs over more than 12,000 feet of inexpensive, twisted copper pair wire, thereby breaking the 300 foot Ethernet distance barrier. Thus, using the LT 300 and up to two XC-RP300's a LAN can be extended over 12,000 feet. This solution provides reliable high-speed data communication in the harshest operating environments. It can also operate in uncontrolled outside plant environments such as in remote terminals or curb-side distribution vaults.

Designed to operate in the harshest environments, the -RP300 has an extended temperature range of - 37°C to +74°C, in non-condensing humidity of up to 95%. The XC-RP300 can be installed at altitudes of up to 10,000 feet.

An XC-RP300 repeater working together with an XC-SLT1000 switch or XC-LT300 and XC-NT 300 point-to-point link can extend high-speed communications by multiple links of over 12,000 feet. POTS/ISDN calls can be made over the VDSL link without data disturbance.

This manual has been designed to help you to install your XC-RP300 repeater. Just follow the step- by-step installation instructions outlined in section titled - Installation.

## FEATURES

- Easy to install standalone VDSL modems—***no configuration required***
- Environmentally hardened for operation in harsh environments
- Auto-sensing full or half-duplex Ethernet
- Auto-sensing 10/100 operation
- Three ports of local Ethernet access
- MDI, MDX sensing
- Extends network connections up to 4,000 ft (1,219 m) over 2-wire 24-AWG unconditioned lines
- 0.7 to 26 Mbps symmetric and asymmetric line rate
- Internal POTS/ISDN splitter on-board
- LED indicators for Power, Ethernet Link & Activity, VDSL Sync
- Surge suppression up to 20 kA (8120 s)
- Switch selectable console access

## APPLICATIONS

The GDI Communications XC-RP300 provides high-speed Ethernet connection between LANs, remote PC's or any other network enabled 10/100BaseT/TX device. Typical point-to-point operation consists of an XC-LT300 located at one end of the LAN extension and an XC-NT300 located at the other end. Data is passed transparently such that the remote LAN appears to be co-located with the local network. The two networks can be separated by up to 4,000 feet. The XC-RP300 extends that distance by an additional 4,000 feet. The XC-RP300 offers up to three local Ethernet access ports allowing Ethernet devices to be attached as "drop offs" at the midpoint of the link. By adding another XC-RP300 the distance between the end points can be extended an additional 4,000 feet. Figure 1 shows a typical application.

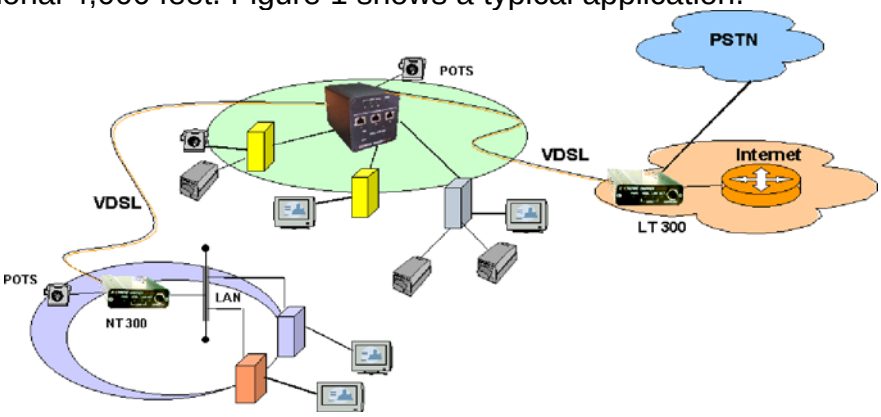



**Figure 1.**
Typical application

The XC-NT300 is well suited to surveillance applications where cameras with digital output capability are placed in strategic locations for observation. The information from the camera can be transmitted to a central collection point. Having the ability to pass voice communication along with high-speed data permits camera positioning information to be sent without interfering with the data. Using an XC-RP300 allows the cameras to placed an additional 4,000 feet from the central collection point. Figure 2 shows a camera application

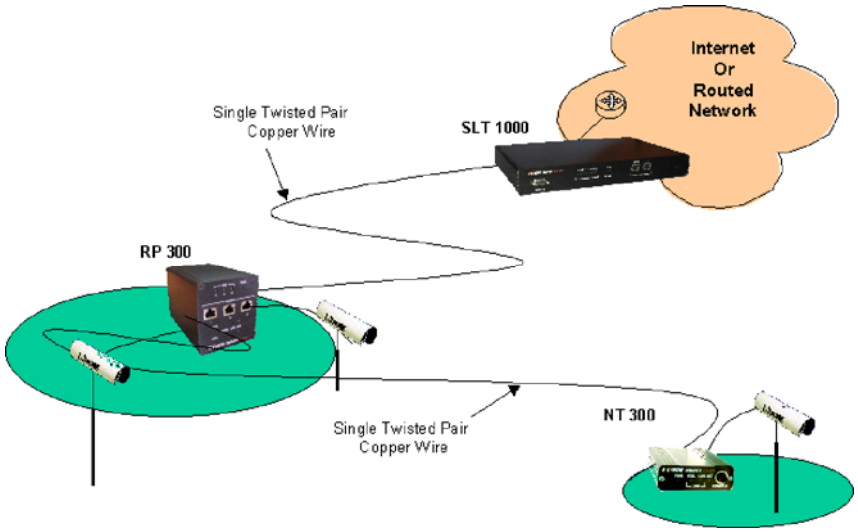



**Figure 2.**
Remote camera application

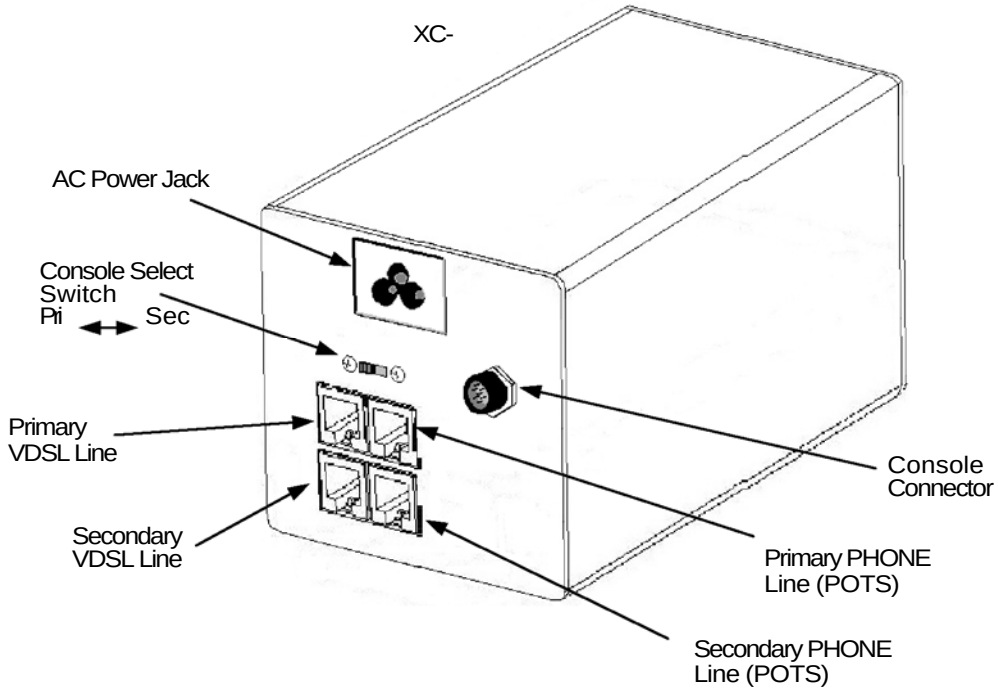
## INSTALLATION

Since basic XC-RP300 setup requires no configuration, it can be installed and made operational quickly. Installation takes place as follows:

1. Connect the VDSL line interface between the units (refer to section titled, “Connecting the VDSL Line Interface” on page 4). See Figure 3 for rear panel connector arrangements.

2. Connect the Ethernet interface (refer to section titled, “Connecting the Switch (Ethernet) Interface” on page 5).

3. Connect the POTS (Plain Old Telephone System) interface to a telephone or telephone line (refer to the section titled “Connecting the POTS/ISDN line” on page 6)




4. Connect the power plug (refer to section titled, “Connecting Power” on page 6).

**Figure 3.**
XC-RP300 rear panel

## CONNECTING TO THE VDSL LINE INTERFACE

The XC-RP300 supports two VDSL connections. Each VDSL connection supports communication over distances of up to 4,000 ft (1,219 m) using 24 AWG (0.5 mm) twisted-pair wire. Actual distance and link performance may vary depending on the environment and type or gauge of wire used.

Follow the steps below to connect the XC-RP300 VDSL Interfaces;

The XC-RP300 has two VDSL connections: a primary and a secondary. The Primary (Pri) is an NT type interface. The Secondary (Sec) is an LT type link. The primary connection terminates the VDSL link to a LT or VDSL Switch. The secondary connection forwards the high-speed connection to a NT type connection that can be an NT 300 or the Primary on another XC-RP300.

To function properly, the units must be connected together using twisted-pair, unconditioned, metal wire, between 19 (0.9mm) and 26 AWG (0.4mm). Leased circuits that run through signal equalization equipment are not acceptable. The interface is bipolar making the TIP and RING connection insensitive to polarity.

TESTING NOTE: The XC-RP300 can be bench tested by connecting the Primary VDSL port to the Secondary VDSL port using at least 100 feet of telephone cable. An attenuator can be used in place of the 100 foot cable. Contact GDI Communications for availability.

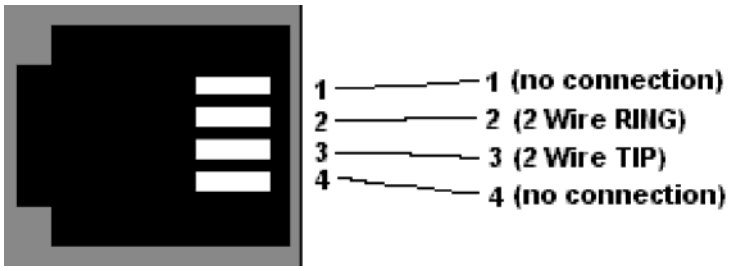



**Figure 4.**
XC-RP300 (RJ11) VDSL line interface.

## CONNECTING THE SWITCH (ETHERNET) INTERFACE

There are three RJ-45 ports on the front of the XC-RP300 labeled “Switch”. These are 10/100BaseT/TX Ethernet interfaces. These ports are designed to connect directly to a 10/100BaseT/TX network. The interface has the ability to detect whether the connection is DCE or DTE and will automatically configure the interface to support the connected equipment. This automatic process is known as MDI /MDX detection. Typical connections are depicted in figures 5 and 6 below. You may connect these ports to other Ethernet devices via a Cat 5 cable that is up to 150m/328ft long.

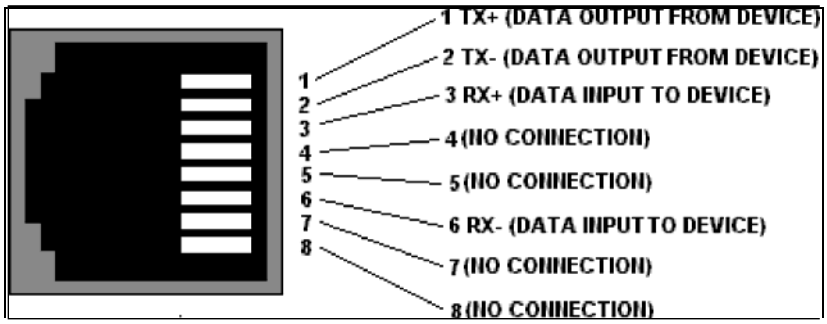
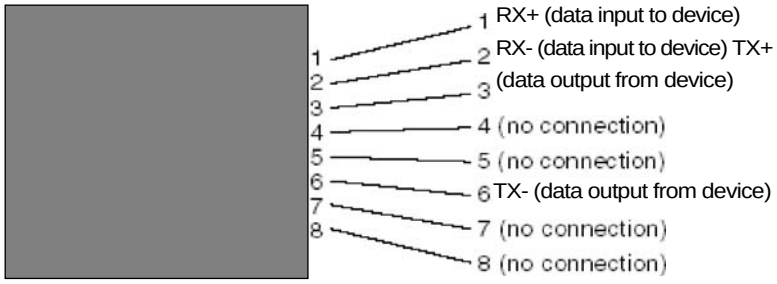



**Figure 5.**




Typical LAN (10/100BaseT/TX) RJ-45 Connector Pin configuration for DTE.

**Figure 6.**
Typical LAN (10/100BaseT/TX) RJ-45 Connector Pin configuration for DCE.

## CONNECTING THE TELEPHONE (POTS/ISDN) LINE

The RJ 11 port labeled “PHONE” is the TELEPHONE or POTS/ISDN interface. A telephone or an ISDN device may be connected to this port and carried over the VDSL line. The XC-RP300 does not need to be powered up for the POTS interface to work. The RJ 11 connector in the XC-RP300 PHONE interface is wired as shown in Figure 7.

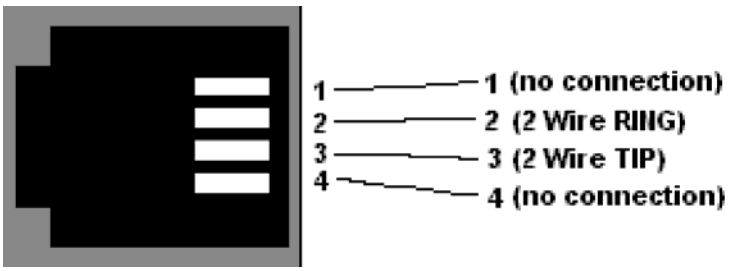



**Figure 7.**
XC-RP300 PHONE (RJ 11, POTS/ISDN) interface

## CONNECTING POWER

There are two power options available for the XC-RP300. The XC-RP300 is equipped with a power jack to accept external power.

The XC-RP300 is supplied with an external AC cube style power supply. Power to the XC-RP300 is connected using the barrel jack on the rear panel. No configuration is necessary at the power supply. DC power must be regulated +5VDC ±5%, 1.0A minimum. The jack on the rear panel is center pin +5V, outer ring Ground (See figure 8 below). The Plug should be a barrel type plug with the following dimensions, 2.5/5.5/10mm (I.D./O.D./Shaft Length). The XC-RP300 does not have a power switch; it powers up as soon as it is properly plugged to the power source.

**Figure 8**
Power jack configuration

## CONNECTING TO THE MANAGEMENT CONSOLE

Access to the management interface is through a rear panel, seven (7) pin mini DIN connector "ref: Tyco 1445721-1 AMP/Tyco Micro CPC". An adaptor cable is required to convert the mini DIN connector to a typical 9-pin serial port connector on a PC. Figure 9 shows the pin assignments for the console connector. The converter cable is described in figure 10. Contact GDI Communications for availability.

The small switch located next to the console connector allows the user to connect to either the Primary (PRI) or the Secondary (SEC) management port.

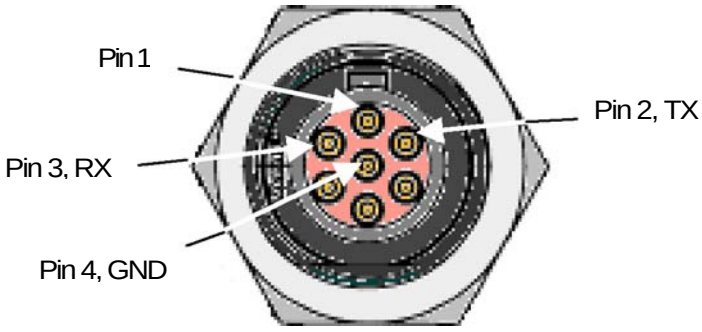



**Figure 9**.
Console connector

## CONSOLE ADAPTER CABLE

| Generic FM-DA-9/Backshell [1] | | AMP/TYCO 1445642-1 with 1604111-1 Strain Relief |
|---|---|---|
| 1 N/C | | |
| 2 | _____ | 2 |
| 3 | _____ | 3 |
| 4 N/C | | |
| 5 | _____ | 4 |

**Figure 10.**
Converter Cable Diagram

[1] typical: PAN PACIFIC*DB9GH-50P, PAN PACIFIC*DH-9HS/T-P10, PAN PACIFIC*DHD-PIN/F-HR-P1C

# OPERATION

Once the XC-RP300 is properly installed, it should operate transparently. No user settings are required. This section describes the LED status monitors.

## POWER UP

Before applying power to the XC-RP300, please review the section titled, “Connecting Power” to verify that the unit is connected to an appropriate power source.

## FRONT PANEL LED STATUS MONITORS

The XC-RP300 features front panel LEDs that monitor the power, Ethernet signals and the VDSL Connection. Figure 11 shows the panel locations of each LED. Table 1 describes the LED functions.

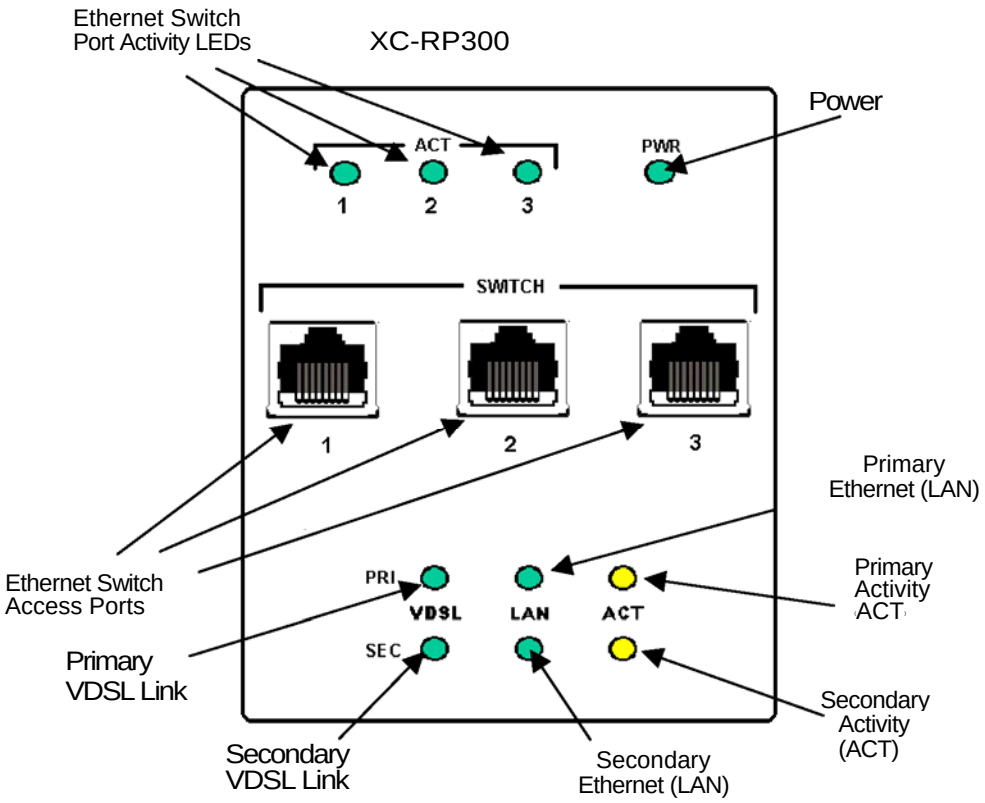



**Figure 11.**
RP 330 Front panel LED location

## LED Description

| LED | Indication |
|---|---|
| Power | Solid GREEN to indicate the unit is powered ON. |
| | |
| ACT | Ethernet Switch Ports “Good Link” and “Activity” |
| 1 | Good Link and data activity for port one |
| 2 | Good Link and data activity for port two |
| 3 | Good Link and data activity for port three |
| | |
| VDSL (Pri) | (Active Green) Solid green (ON) to indicate that the end-to-end VDSL link between the XC-RP300 Primary VDSL modem and an LT 300 or SLT 1000 VDSL Switch is established. The VDSL LED is OFF when the link is down. |
| VDSL (Sec) | (Active Green) Solid green (ON) to indicate that the end-to-end VDSL link between the XC-RP300 Secondary VDSL modem and an NT 300 or XC-RP300 Primary port is established. The VDSL LED is OFF when the link is down. |
| | |
| LAN (Pri) | (Active Green) Solid Green indicates that Ethernet link has been established with the internal Ethernet Switch. The LAN LED is OFF when the link is down. |
| LAN (Sec) | (Active Green) Solid Green indicates that Ethernet link has been established with the internal Ethernet Switch. The LAN LED is OFF when the link is down. |
| | |
| Act (Pri) | (Active Yellow) Flashes to indicate Ethernet activity on the Primary 10/10013ase-T Ethernet port. |
| Act (Sec) | (Active Yellow) Flashes to indicate Ethernet activity on the Secondary 10/10013ase-T Ethernet port. |

**Table 1:**
Front panel LED description

# CONFIGURING THE XC-RP300

The XC-RP300 is factory configured to customer default specification before shipment. Configuration options are in tables 2 and 3.

To configure the XC-RP300 in the field you will need an adapter cable, a PC with a serial port and the 10BaseS GUI software tool. The 10BaseS GUI is available from GDI Communications. Please contact GDI Communications to obtain this software tool. The adapter cable information can be found in Appendix C. The PC will need to have a serial port or conventional USB serial port adaptor and be running a Windows 98 or later operating system. Connect the PC to the console port on the XC-RP300. Set the console select switch to the SEC (Secondary) position. Using an in-line attenuator, connect the Primary VDSL port to the Secondary VDSL port. The VDSL Sync LED on both the Primary and Secondary should illuminate. Open the GUI by double clicking on the 10BaseS icon. The “Startup” dialogue box will appear. Select the COM port for your PC.

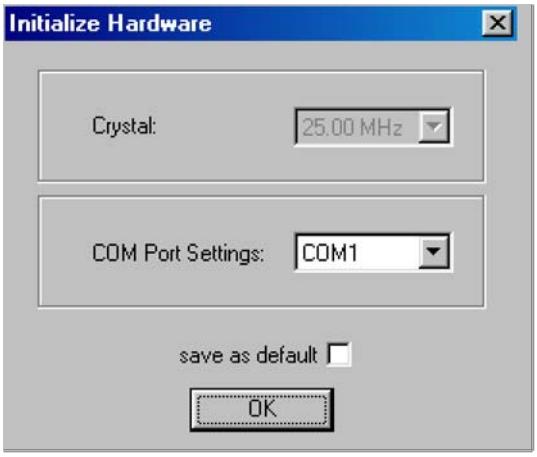



**Figure 12**
Startup dialog box

After the GUI comes up it will show the “General Settings” screen.

Select the Link Configuration tab. It will show the present configuration in the selected modem.

From the Rate table, select the new rate you want to configure. From the table determine the (Downstream) DS Interpolation, DS Constellation and DS Carrier Frequency. Make the desired changes.

Determine the (Upstream) US Interpolation, US Constellation, and US Carrier Frequency. Make the desired changes.

Click on the Write & Update button.
The Write & Update Dialogue box will appear. Click on OK. Observe the following: the update process will begin, and the VDSL Sync LED will turn OFF. When the update process is completed the VDSL sync LED should illuminate again.
The configuration information displayed will update with the latest configuration.

Note: The link configuration can only be changed from an LT unit.

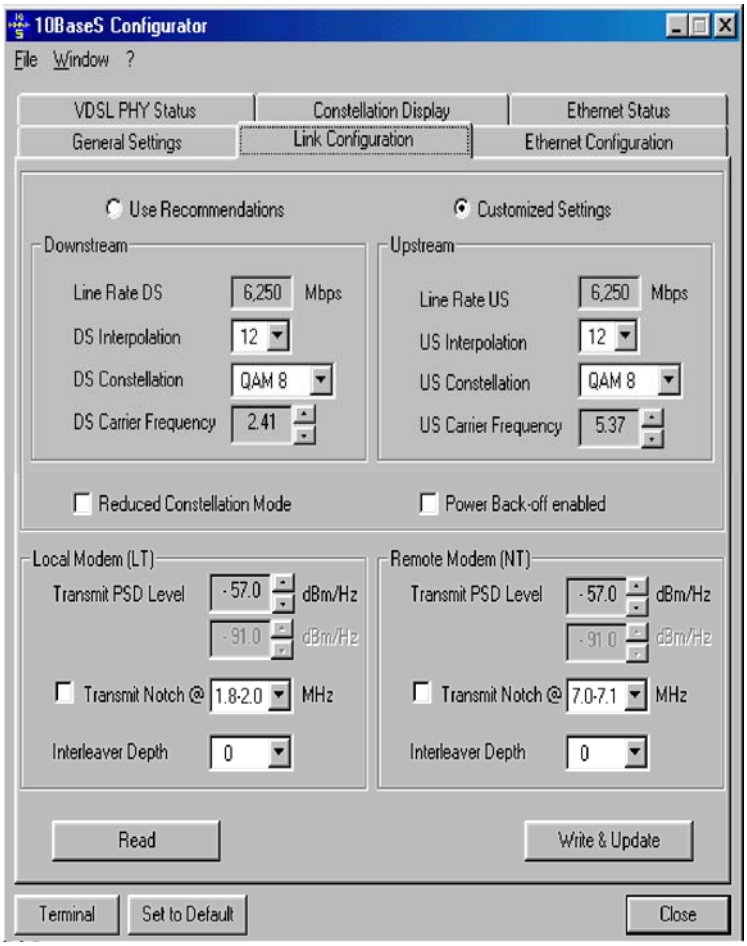



**Figure 13**
Link Configuration Tab

**Available Downstream Line Rates**

| Line Rate (Mbps) | Interpolation | QAM | Center Frequency |
|---|---|---|---|
| 0.78 | 64 | 4 | 1.10 |
| 1.04 | 48 | 4 | 1.16 |
| 1.17 | 64 | 8 | 1.10 |
| 1.56 | 64 | 16 | 1.10 |
| 1.56 | 48 | 8 | 1.16 |
| 1.56 | 32 | 4 | 1.29 |
| 2.08 | 24 | 4 | 1.42 |
| 2.08 | 48 | 16 | 1.16 |
| 2.34 | 64 | 64 | 1.10 |
| 2.34 | 32 | 8 | 1.29 |
| 3.13 | 64 | 256 | 1.10 |
| 3.13 | 48 | 64 | 1.16 |
| 3.13 | 32 | 16 | 1.29 |
| 3.13 | 24 | 8 | 1.42 |
| 3.13 | 16 | 4 | 1.68 |
| 4.17 | 48 | 256 | 1.16 |
| 4.17 | 24 | 16 | 1.42 |
| 4.17 | 12 | 4 | 1.94 |
| 4.69 | 32 | 64 | 1.29 |
| 4.69 | 16 | 8 | 1.68 |
| 6.25 | 32 | 256 | 1.29 |
| 6.25 | 24 | 64 | 1.42 |
| 6.25 | 16 | 16 | 1.68 |
| 6.25 | 12 | 8 | 1.94 |
| 8.33 | 24 | 256 | 1.42 |
| 8.33 | 12 | 16 | 1.94 |
| 9.38 | 16 | 64 | 1.68 |
| 12.5 | 16 | 256 | 1.68 |
| 12.5 | 14 | 128 | 1.79 |
| 12.5 | 12 | 64 | 1.94 |
| 12.5 | 10 | 32 | 2.15 |
| 16.67 | 12 | 256 | 1.94 |

Table 2
Downstream Rates

**Available Upstream Line Rates**

| Line Rate (Mbps) | Interpolation | QAM | Center Frequency |
|---|---|---|---|
| 0.78 | 64 | 4 | 4.20 |
| 1.04 | 48 | 4 | 4.26 |
| 1.17 | 64 | 8 | 4.20 |
| 1.56 | 64 | 16 | 4.20 |
| 1.56 | 48 | 8 | 4.26 |
| 1.56 | 32 | 4 | 4.39 |
| 2.08 | 24 | 4 | 4.52 |
| 2.08 | 48 | 16 | 4.26 |
| 2.34 | 64 | 64 | 4.20 |
| 2.34 | 32 | 8 | 4.39 |
| 3.13 | 64 | 256 | 4.20 |
| 3.13 | 48 | 64 | 4.26 |
| 3.13 | 32 | 16 | 4.39 |
| 3.13 | 24 | 8 | 4.52 |
| 3.13 | 16 | 4 | 4.78 |
| 4.17 | 48 | 256 | 4.26 |
| 4.17 | 24 | 16 | 4.52 |
| 4.17 | 12 | 4 | 5.04 |
| 4.69 | 32 | 64 | 4.39 |
| 4.69 | 16 | 8 | 1.68 |
| 6.25 | 32 | 256 | 4.39 |
| 6.25 | 24 | 64 | 4.52 |
| 6.25 | 16 | 16 | 4.78 |
| 6.25 | 12 | 8 | 5.04 |
| 6.25 | 8 | 4 | 5.56 |
| 8.33 | 24 | 256 | 4.52 |
| 8.33 | 12 | 16 | 5.04 |
| 9.38 | 16 | 64 | 4.78 |
| 9.38 | 8 | 8 | 5.56 |
| 12.5 | 16 | 256 | 4.78 |
| 12.5 | 14 | 128 | 4.89 |
| 12.5 | 12 | 64 | 5.04 |
| 12.5 | 10 | 32 | 5.25 |
| 12.5 | 8 | 16 | 5.56 |
| 16.67 | 12 | 256 | 5.04 |
| 18.75 | 8 | 64 | 5.56 |
| 25 | 8 | 256 | 5.56 |

Table 3
Upstream Rates table

# MANAGEMENT INTERFACE

The 10BaseS Manager provides a comfortable graphical user interface (GUI) to the registers of 10BaseS chipset. The GUI enables the user to change the configuration features as well as to monitor the status of the VDSL modems.
It supports access of the remote modem via the VDSL Operating Channel (VOC) making configuration very easy.
The possibility of writing register dumps to files is useful for easily storing different settings and helpful for gaining a deeper understanding of the register structure. Via an integrated terminal, the configuration process is visualized even on register level.

### Optional Programming Protocol on the Serial Host Interface

The 10BaseS Manager accesses the modem through the console port on the XC-RP300. The console port is a serial host interface. Therefore, a simple ASCII protocol has been implemented to access the internal control unit. *Please note that use of this programming protocol is completely optional and is by no means required for robust configuration and operation.* **Table 4** shows the supported commands.

| Opcode | Field 1 | Field 2 | Notes |
|---|---|---|---|
| WR | Address | Data | Write data to address |
| RD | Address | Data | Read data from address |
| OR | Address | Data | OR data with data @ address |
| ND | Address | Data | AND data with data @ address |

**Table 4 Serial Interface Commands**

```
Examples:
Writing 0x20 to address 0x8C00:
WR 8C00 20
Reading from address 0x8C00 for 25 bytes:
RD 8C00 25
Clearing bit 0 at address 0x8C25:
ND 8C25 FE
Setting bit 1 at address 0x8C25:
OR 8C25 02
```

The XC-RP300 uses a prompt (L>) to indicate to the user that it is ready for communication. The programmer may perform a Write (WR) to an address, request a Read (RD) of that address and then view the value given back. A standard sequence will look like the following:

```
10BaseS-D B3.0 LT-E2-FF
L> WR 8C00 20
L> RD 8C00
8C00: 20
L>
```

**VOC channel access**

The remote modem can be accessed via the VDSL operating channel (VOC).
Therefore, the VDSL Manager User's Manual has special VOC registers, which have to be used.
The VOC protocol consists of following steps:

1. Check MS_TXCMD register.
   The MS_TXCMD register has to equal zero, which indicates that the internal processor is ready for a new VOC operation.
2. Write appropriate data to the VOC message registers.
   The VOC registers have to be loaded with the appropriate VOC message. The message characteristics contain the address of the remote register, data to write to the remote register (if required), number of bytes to transfer and the message ID.
3. The VOC operation has to be started by loading the MS_TXCMD register with the appropriate command (e.g. read or write). Once the internal processor sees a change in the MS_TXCMD register, it sends the message over the VDSL link via the VOC.
4. Poll MS_RXSTAT register for message acknowledge. The message status register MS_RXSTAT has to be monitored in order to check for acknowledge and type of received messages.

This protocol is implemented in the VDSL Manager for accessing the remote modem. For more detailed information please refer to the VDSL Modem User's Manual data sheet.

# MANAGEMENT SOFTWARE DESCRIPTION

## Start-up Dialog

When the Manager starts, the COM select dialog box appears. The user has to select the COM port that is connected to the VDSL modem. If the SAVE AS DEFAULT check box is checked, the settings are stored and will be available on the next start-up.

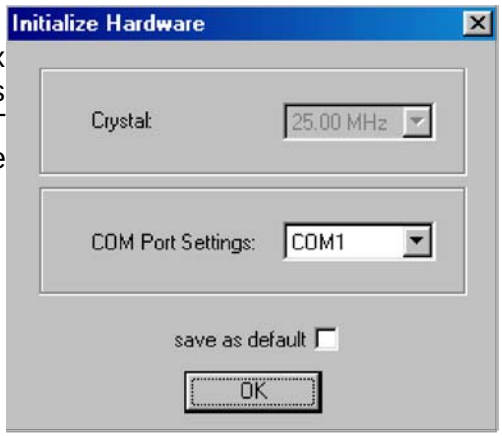



Figure 14 Startup Dialog

## General Settings Page

The general settings page allows basic settings of the VDSL Bridge Manager. Both, local and remote modem (if available and synchronized) can be addressed by this window.

The following functions are supported on the General Settings page:

**Modem Type Display**: Indicates which modem type (LT or NT) is the local and remote modem.

**Reset:** Performs a soft reset of the modem. After a soft reset, the VDSL is held in reset state for 256 clocks.

**Local Loop back:** Returns data from the TX port of the VDSL to the RX port of the VDSL. The transmitted data to the line is not guaranteed when the local loop back is activated. This feature is not supported on the far-end modem since this would bring down the link.

**Line Loop back:** Connects the output port of the VDSL TC-layer to the TC-layer input. This loop back contains the Ethernet interface, the scrambler, the Reed Solomon block, interleaver, framer and synchronizer.

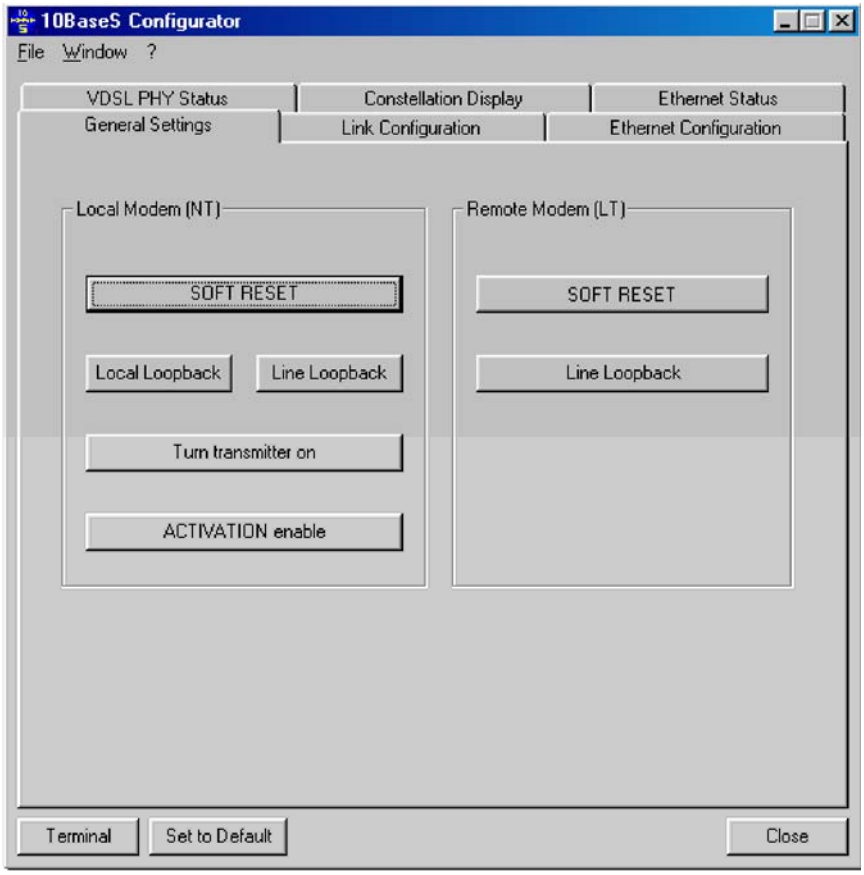



**Figure 15 General Settings Page**

**Turn transmitter on/off**: This button turns the transmitter on/off in case a VDSL link is not established. This feature serves for test purposes, e.g. to monitor the spectrum with a spectrum analyzer.

**Activation disable/enable:** This button enables the user to enable or disable the VDSL link

## Ethernet Configuration Page

Following sub-menus can be chosen:

**General Settings:** this is a list of sub menus for easy configuration of the Ethernet interface.

**MAC Command:** In MAC mode this sub-menu allows configuration of the interfaced Ethernet PHY device directly.
***Note: This window is only valid in MII MAC mode.***

**Backpressure Control:** Allows control of the back pressure features of the modem

**Flow Control:** Controls the flow control settings of the modem.

**Auto-Aging:** Controls the address aging settings of the modem

**MII - SMI PHY Access:** In MAC mode this sub-menu allows direct access to the interfaces Ethernet PHY via the Serial Management interface (SMI).
***Note: This window is only valid in MII***
***MAC mode***

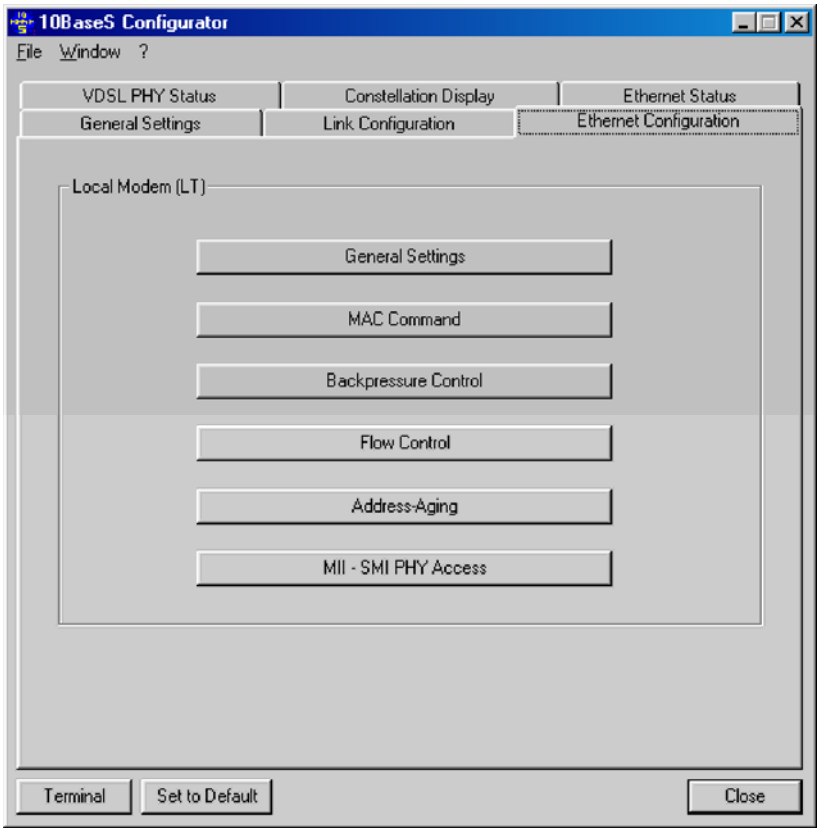



**Figure 16 Ethernet Configuration Page**

## General Settings

Following settings are supported:

**Maximum Packet Size:** Allows configuring the VDSL for the standard packet size (1518 bytes) or the extended size (1536 bytes).

**Speed:** Selects either 10Mbps or 100Mbps.
***Note: This setting is only valid in MII PHY mode. In MII MAC mode the speed is automatically set during auto-negotiation or by activating the FORCE procedure described in the section in MAC Command, Trigger FORCE.***

**Duplex Mode:** Selects either half duplex or full duplex mode.
***Note: This setting is only valid in MII PHY mode. In MII MAC mode the duplex mode is automatically set during auto-negotiation or by activating the FORCE procedure described in the section in MAC Command, Trigger FORCE.***

**MII Data Path Machine enabled:** The data path must always be enabled; otherwise, no payload data can be transmitted.

**CRC Check enabled:** Enable or disable the CRC check.

**Back Signaling enable:** Enable or disable the back signaling feature of the 10BaseS-D. For configuration of the back signaling features please refer to Flow Control section

**Figure 17 Ethernet Configuration – General Settings**

## General Settings (continued)

**Automatic Auto-Negotiation:** If enabled, speed and duplex mode is automatically negotiated with the link partner. Otherwise, the auto-negotiation procedure can be triggered manually. Please refer to ***the section in MAC Command*** for operating in this mode.

**Address:** Allows selection of the address filtering option from disabled to up to 32 addresses.

**MDIO Direction:** Determines the direction of the MDIO (Management data input/output) signal. In VDSL MAC mode, the management interface has to be the clock master. In VDSL PHY mode the management interface has to be the clock slave.

**PHY Address:** Address sampled from PHY Address pins (pins 73-74, 77-78, 72) upon reset.
***Note: This address has to match the PHY address of the interfaced Ethernet PHY. Otherwise, no communication via the serial management interface is possible.***

**Reset Ethernet Data Path Machine:** Resets the Ethernet interface block in the VDSL Modem.

## MAC Command

***Note: These settings are only available in MII MAC mode.***

**Trigger Auto-Negotiation:**
Triggers Auto-Negotiation with the advertising arguments given.
***Note: Depending on the Ethernet configuration of the system this procedure changes the Ethernet configuration registers adjusted in the General Settings page (see the section General Settings)***

**Trigger FORCE:**
Forces the interfaced Ethernet PHY to work with the adjusted speed and duplex mode.
***Note: Depending on the Ethernet configuration of the system this procedure changes the Ethernet configuration registers adjusted in the General Settings page (see the section General Settings)***

**PHY Link:**
Reflects the LINK bit in the Basic Mode Status Register (BMSR) of the interfaced Ethernet PHY and indicates that an Ethernet link is established.

**PHY Auto-Negotiation done:**
Reflects the Auto-Negotiation Complete bit in the Basic Mode Status Register (BMSR) of the interfaced Ethernet PHY and indicates that the Auto-Negotiation procedure is completed.

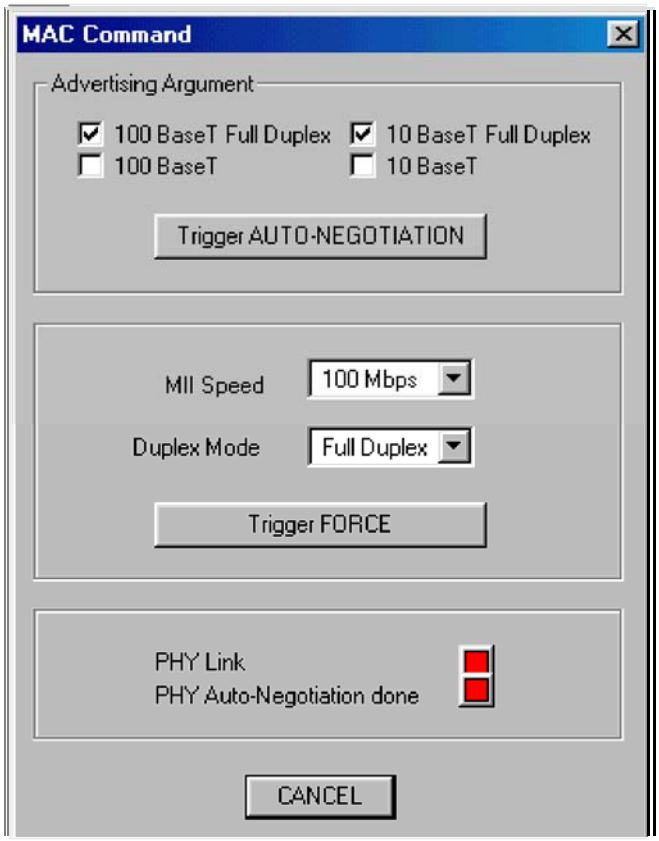



**Figure 18 Ethernet Configuration - MAC Command**

**Back pressure Control**

The receive buffer may grow faster than it is emptied out over the VDSL link. If in half duplex mode (see **section General Settings** and **the section MAC Command**), back pressure can be used to control and manage the traffic. Back pressure is implemented by transmitting a continuous preamble after a standard IPG.

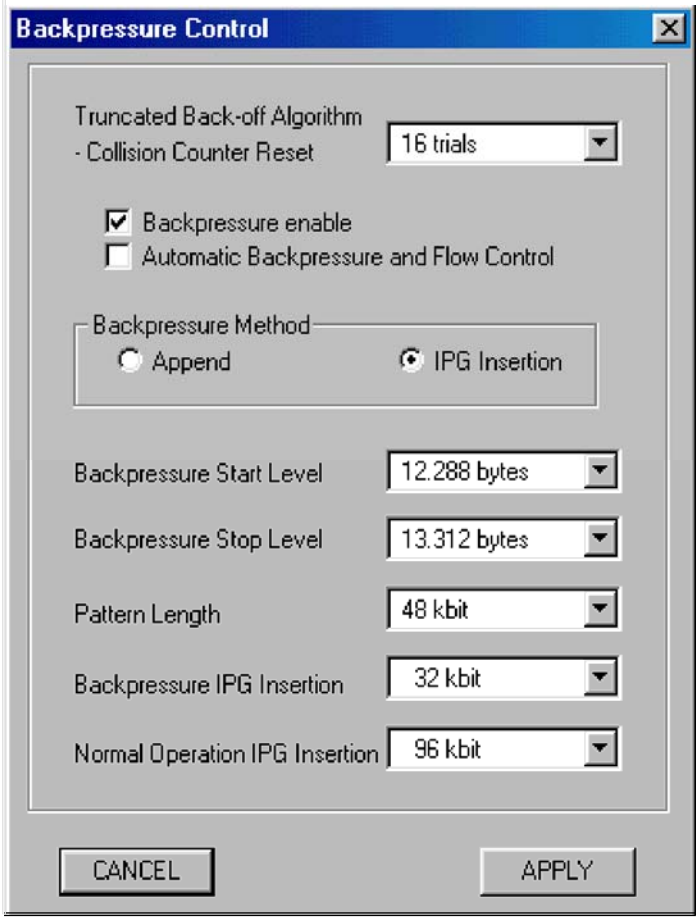



**Figure 19 Ethernet Configuration – Back pressure Control**

**Truncated Back-off Algorithm - Collision Counter Reset:** Controls the truncated back-off algorithm. To achieve a more aggressive transmitter behavior the collision counter can be reset after a programmable number of attempts. Once the counter is reset the algorithm is reset thus allowing shorter IPGs to be statistically inserted. Packets are not discarded in any case.

**Back pressure enable:** Enables or disables the back pressure functionality.

**Automatic Back pressure and Flow Control:** In MAC mode, the Back Pressure and Flow Control mechanisms are automatically activated or deactivated according to the speed and duplex configuration (see **General Settings** and **MAC Command sections**) and IEEE 802.3. If this feature is disabled, Back Pressure and Flow Control must be manually set.

**Back pressure Method:** Select the back pressure method:

**Append:** Append packet coming from the 10BaseS link into the transmit FIFO to the continuous preamble of any length.

**IPG Insertion:** Insert IPG before generating a legal preamble for the packet that enters the transmit FIFO during back pressure.

**Back pressure Start Level:** Back pressure is started when the level of the receive FIFO defined in this field is exceeded. The size of 'max packet size' is either 1518 or 1536 bytes as it was defined in the General Settings menu (see **General Settings**).

**Back pressure Stop Level:** Back pressure is stopped when the receive FIFO level drops below the limit adjusted in this field. The size of 'max Packet size' is either 1518 or 1536 bytes as it was defined in the General Settings menu (see **General Settings**).

**Pattern Length:** Length of preamble before IPG insertion when back pressure is activated.

**Back pressure IPG Insertion:** IPG length between two consecutive patterns when back pressure is activated.

**Normal Operation IPG Insertion:** IPG length between two consecutive patterns while normal operation, i.e. when back pressure is not activated.

## Flow Control

If operating in full-duplex mode, the MII interface can apply IEEE 802.3x flow control.

**Flow Control enable:**

Enables or disables flow control.

**Automatic Back pressure and Flow Control:**

In MAC mode, Back Pressure and Flow Control mechanisms are automatically activated or deactivated according to the speed and duplex configuration (see **General Settings** and **MAC Command sections**). If this feature is disabled Back Pressure and Flow Control must be manually set.

**Pause Packet Handling: discard**: PAUSE packets are discarded, **forward**: PAUSE packets are forwarded to the 10BaseS link

**Flow Control Start Level:** PAUSE packets are generated if less than the adjusted amount of free space is left in the receive FIFO.

**Flow Control Stop Level:** Generation of PAUSE packets is stopped if more than the adjusted amount of free space is left in the receive FIFO.

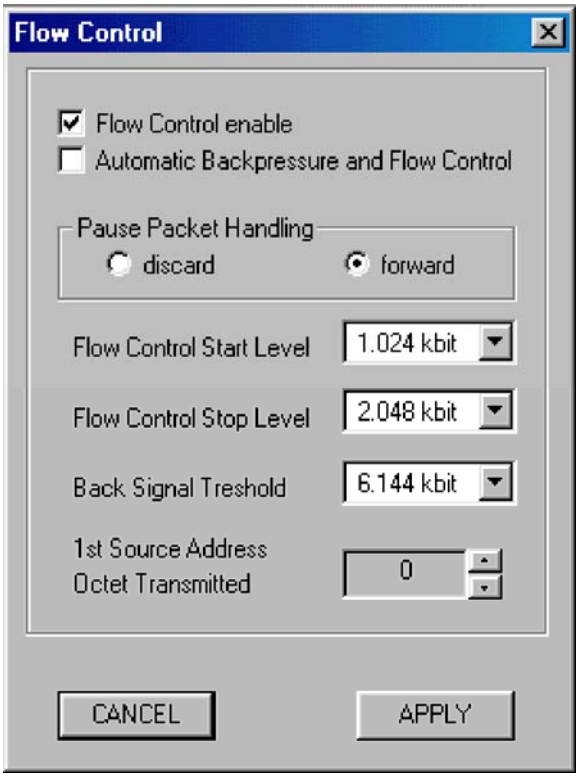



**Figure 20 Ethernet Configuration - Flow Control**

**Back Signaling Threshold:** Back Signaling is started if the adjusted receive buffer threshold is exceeded.

**1st Source Address Octet Transmitted:** Defines the first PAUSE source address octet, which is transmitted. The next 40 bits are 0.

## Address Aging

Address aging is supported for topology changes such as an address moving from one side of the 10BaseS link to another. When this happens, the MII detects the change and updates its address table accordingly. Aging can be fully automatic or triggered manually.

**Address Aging: Manual**: Address aging is controlled manually. **Automatic**: Address aging is done automatically.

**Trigger Address Aging:** Triggers one aging scan of the address table. Two scans are necessary to" age out" an address.

**Age out all:** Age out all 32 addresses stored in the address table, i.e. clear address table.

**Source Address Control:** Fetch first Address: Fetch first address from address table. Fetch next Address: Fetch next address from address table.

**Automatic Aging Trigger:** If automatic address aging is selected, the address table is scanned and aged out automatically after every adjusted bit-time.

**Last Address reached:** Indicates that the address counter points to the last address of the address table.

**Address Validity:** Indicates that the address is valid.

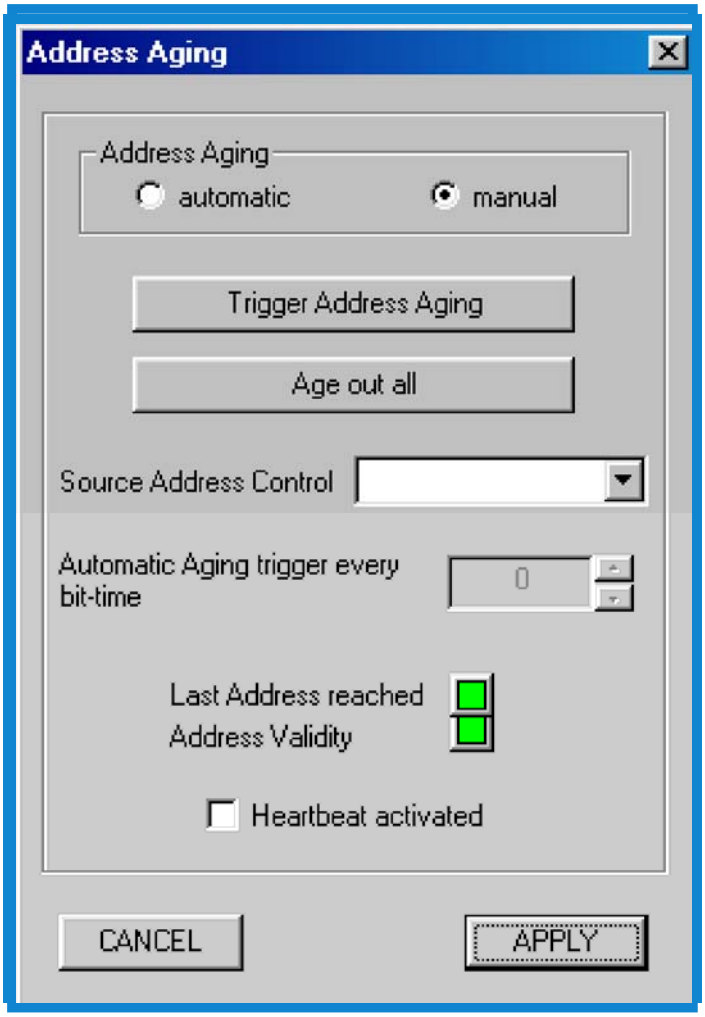



**Figure 21 Ethernet Configuration - Address Aging**

**Heartbeat activated:** Heartbeat test signal is generated if checked.

**MII - SMI PHY Access**

If in MII MAC mode, the 10BaseS-D supports direct access to the interfaced Ethernet PHY via the MII Serial Management Interface (SMI).

**PHY Address:** The Ethernet PHY address has to be specified in this field. The Ethernet PHY samples its address upon entry. On the VDSL Modem the Ethernet PHY has the address 1 assignment.

**SMI Register:** The SMI register of the Ethernet PHY must be specified in this register.

**SMI Data:** The data in the 16bit SMI register is displayed or can be changed via these check boxes.

**Read Access:** Read data from Ethernet PHY

**Write Access:** Write data to Ethernet PHY.

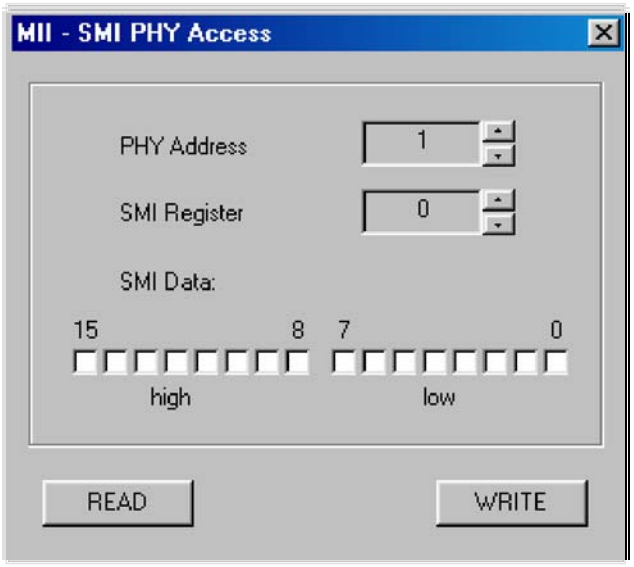



**Figure 22 Ethernet Configuration - MII - SMI PHY**

## Link Configuration Page

The Link Configuration window shown in Figure 23 allows access to the PMD (Physical Media Dependent) registers of the VDSL Modem. Both local and remote modems (if available and synchronized) can be addressed by this window.

The following functions are available within the Link Configuration page:

**Customized Settings:**

If this option is selected, the user has access to the entire bandwidth via adjustable constellations and interpolations as well as carrier frequency settings. Thus you can find the appropriate line rate for a particular application.

**Use Recommendations:** In this option, the user can change the line rate of the modem by selecting approved constellations and interpolations.

**Line Rate:** Line rate depends on the on-board crystal. The line rate depends on the selected QAM constellation and interpolation.

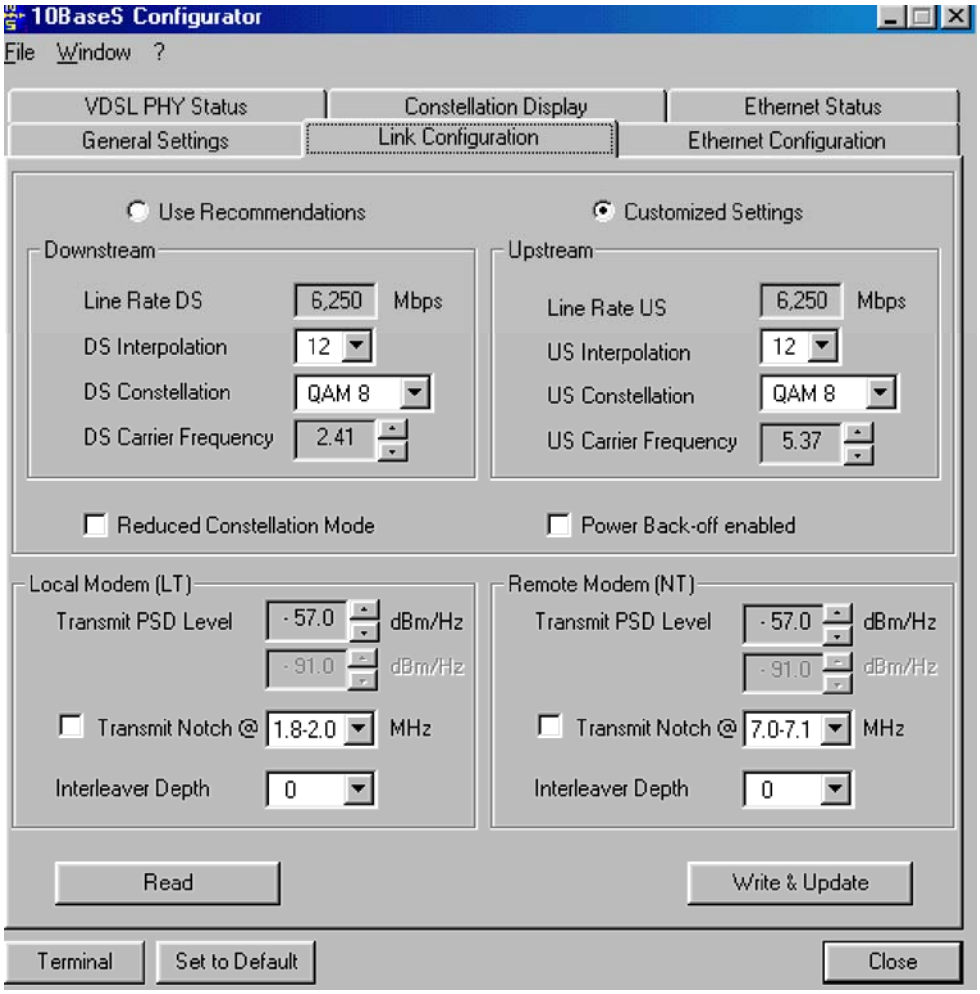



**Figure 23 Link Configuration Page**

Line Rate is calculated as follows:
Line Rate = Baud Rate * N [Mbps] with:

Baud Rate = fsample / interpolation [Symbols per second]
N = log2(QAM size) [Bits per symbol]
Example: Fcrystal = 19.44 MHz, QAM64, Interpolation 12
Baud Rate = 19.44 MHz / 12 = 1.62 Symbols per second
N = log2(64) = 6
Line Rate = 1.62 Symbols per second * 6 = 9.72 Mbps

**Note see Line Rate tables 2 and 3**

**Interpolation:** This drop down menu provides access to all possible interpolation settings for the different QAM selections. If 'Use Recommendations' is chosen it displays the interpolation corresponding to the selected line rate.

**Constellation:** This drop down menu allows you to select one of the supported QAM constellations. If 'Use Recommendations' is chosen it displays the QAM constellation corresponding to the selected line rate.

**Carrier Frequency:** Here the carrier frequency for the upstream and downstream band can be selected. If 'Use Recommendations' is chosen it displays the default carrier frequency.

**Reduced Constellation Mode:** If this check box is enabled, the modem will setup a link in reduced constellation (QAM4) only. It will not switch to full constellation. In reduced constellation mode, the VDSL Operating Channel (VOC) is available for reconfiguring the link manually.

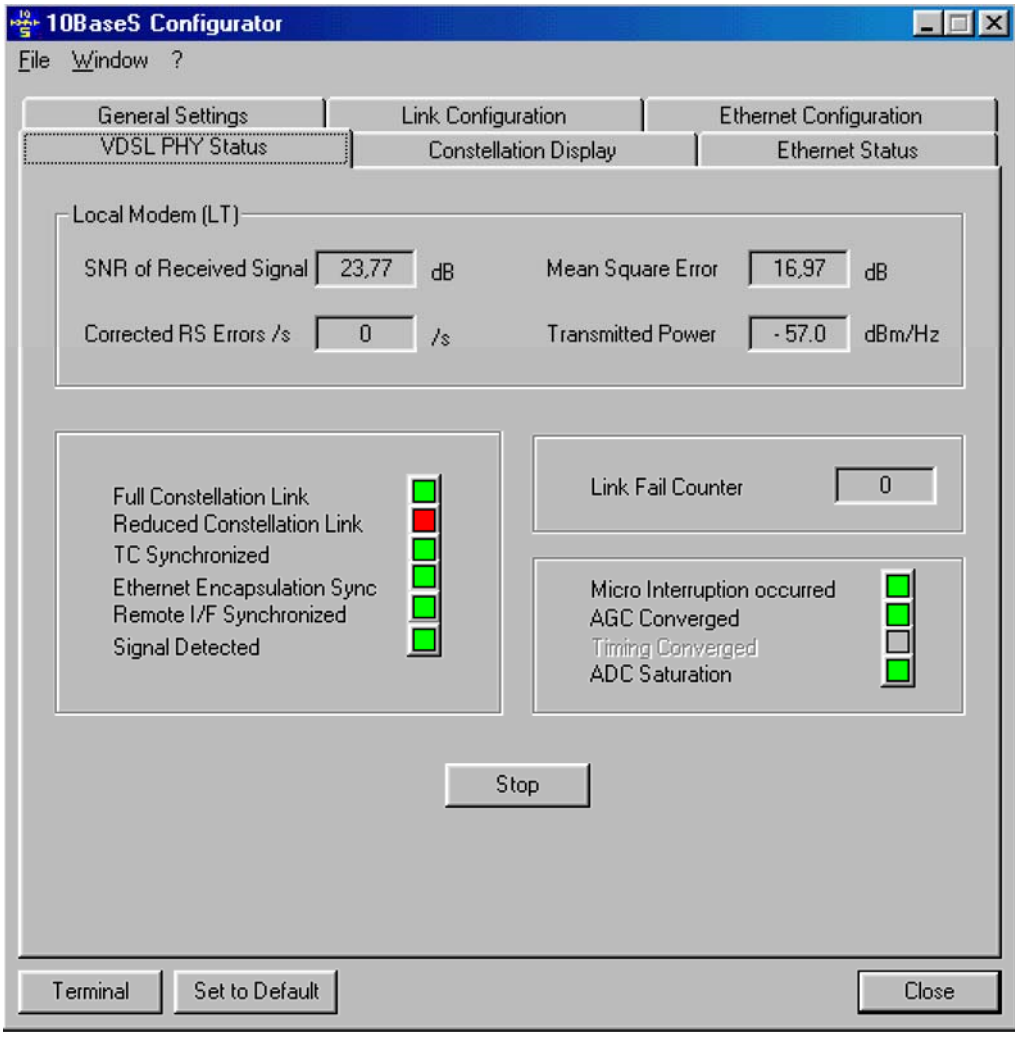
**Power back-off enabled:** This check box controls the Power Back-Off (PBO) functionality. The PBO mechanism optimizes the transmitted power so that the upstream band will use the minimum required transmit power. This feature minimizes VDSL upstream interferences in cases where the remote modems are located at different distances from the Central Office (CO). The PBO can be disabled and the user can explicitly fix the power level by controlling the PSD level manually. The PBO uses the VOC channel to transmit indications from the LT to the NT on the quality of the upstream receive signal. The PBO starts from the MIN_PSD transmission power and increases the power in 1 dB increments until an indication of “good quality” is received from the LT. At the end of the PBO process, the NT transmits the minimum power required by the LT, plus a 6 dB margin. **Power Spectral Density (PSD):** With PBO disabled, this field holds the transmit PSD level. On an NT with PBO enabled a second field appears. One field holds the maximum transmit PSD level; the second field holds the minimum transmit PSD level.

**Notch Filter:** In order to avoid interference with other systems (RF, amateur radio, etc.) which use narrowband transmission in the VDSL band, a notch can be set in the transmit band. The appropriate notch frequency has to be adjusted in the transmit notch field.

**Interleaver Depth:** The protected portion of the VDSL frame can be passed through a convolution interleaver/ de-interleaver that protects the data together with the RS coding, from bursts of noise with a duration of up to 300 µs at full rate. The total latency consists of the latency caused by the RS encoding and the delay caused by interleaving. The parameter M, which can be adjusted in the interleaver field, is used to define the length of protection supported by the interleaving function. The value of “0” defines no use of the interleaver and the maximum value of 16 defines the maximum protection. The values 0,1,2,8 and 16 are valid.

## VDSL PHY Status Page

The VDSL PHY Status page shown in Figure 24 represents the current link status of the local modem. This window is refreshed every five seconds. The status page shows the following values:




**SNR of Received Signal:** The SNR of the received signal is calculated from the parameters found in the PMD layer. The SNR calculation depends on the QAM constellation of the received signal.

**Mean Square Error:** The mean square error is an indication of the symbol error rate. Its calculation depends on the QAM constellation and the SNR of the received signal.

**Corrected RS Errors/s:** This field gives the number of corrected Reed Solomon errors per second. It is an indication of the bit error rate on the line due to disturbers.

**Transmit Power:** This field shows the actual transmitted power level.

On LT modems with PBO enabled this value may be different from the minimum and maximum PSD level adjusted on the Link Configuration Page (see **Link Configuration section**)

**Full Constellation Link:** Indicates that the full constellation link is working and the modem can transmit and receive data

**Reduced Constellation Link:** The modem has synchronized in reduced constellation mode; (QAM4) only. In this state the VDSL Operating Channel (VOC) is working and the VOC channel can be used to re-configure the link.

**TC Synchronized:** Indicates that the transmission convergence layer (TC) is synchronized. VDSL frame acquisition is working properly and the modem is in SYNC state

**Ethernet Encapsulation Sync:** Indicates that the Ethernet data path machine has synchronized. In this state, payload data transmission is working properly.

**Remote I/F Synchronized:** Indicates that the remote data interface is synchronized.

**Signal Detected:** Indicates that a signal is detected after the Analog-to-Digital Converter (ADC).

**Micro Interruption occurred:** Indicates that a micro interruption (<10ms) has occurred.

**AGC Converged:** Indicates that the automatic gain control (AGC) has converged.

**Timing Converged:** Indicates that the timing acquisition function is converged. This indication is only active in an LT configuration.

**ADC Saturation:** Indicates a saturation of the ADC due to strong noise.
**Link Fail Counter:** Counts the VDSL link failures since the first synchronization.

## Constellation Display Page

The constellation display page shown in Figure 25 displays the QAM constellation of the received signal in the complex domain. Registers are read at one-second intervals.

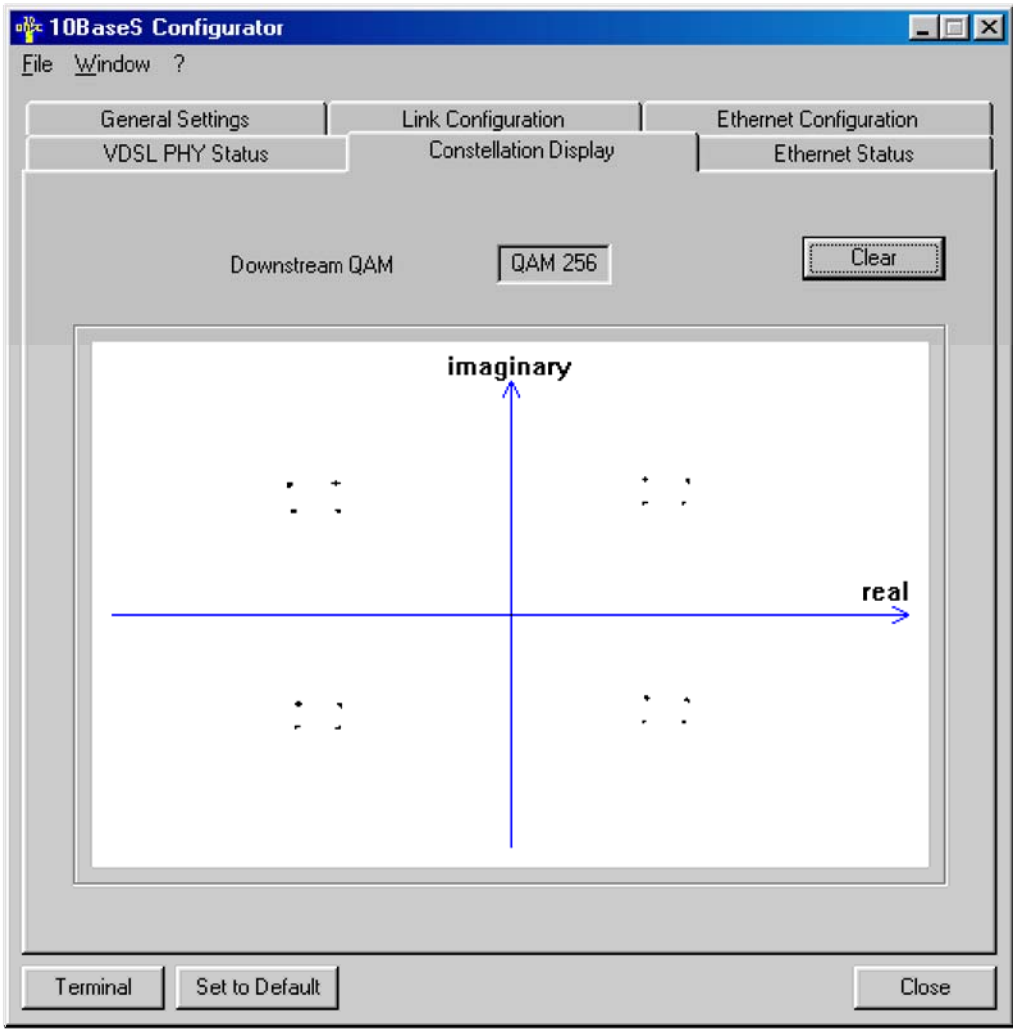



**Figure 25 Constellation Display Page**

## Ethernet Status Page

The Ethernet Status Page comprises all counters that support the Management Information Base (MIB) based on RFC1757. The following RMON Group 1 statistics counters are displayed:

1. **Transmission Counters: Transmitted Frames:**

   Counts the successfully transmitted frames.

   **Received Frames:**

   Counts the successfully received frames.

   **Transmitted Pause Frames:**

   Counts the transmitted pause frames.

   **Received Pause Frames:**

   Counts the received pause frames.

   **Transmitted Octets:**

   Counts the successfully transmitted octets.

   **Received Octets:**

   Counts the successfully received octets.

   **Received Broadcast Frames:**

   Counts the successfully transmitted frames which are directed to a broadcast address.

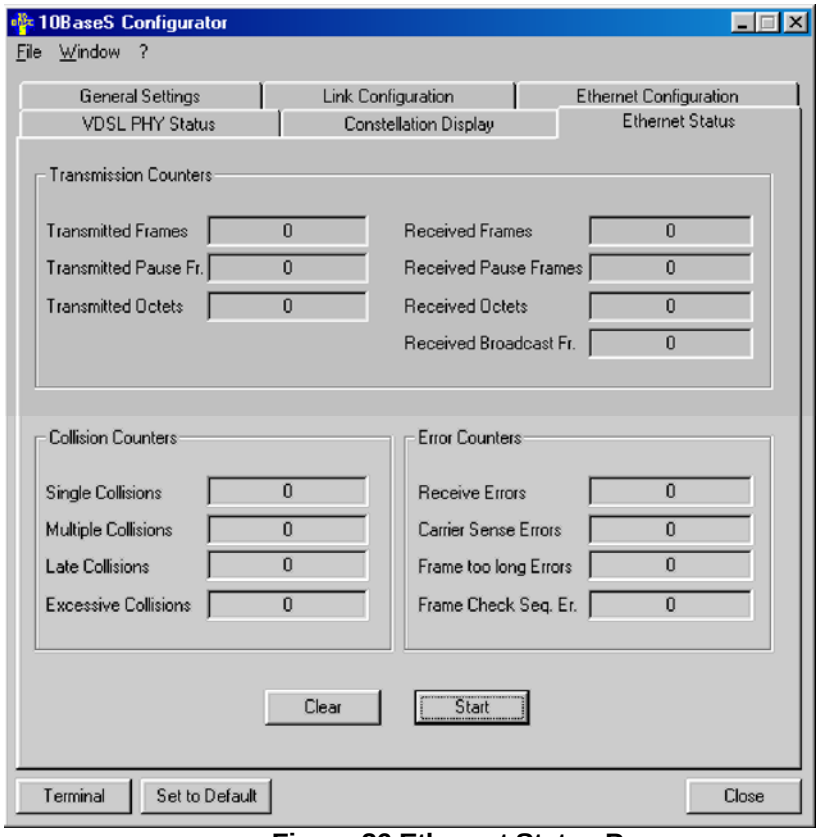



**Figure 26 Ethernet Status Page**

2. **Collision Counters**

   **Single Collisions:** Counts successfully transmitted frames for which transmission was inhibited by exactly one collision.

   **Multiple Collisions:** Counts successfully transmitted frames for which transmission was inhibited by more than one collision.

   **Late Collisions:** The number of times that a collision was detected on a particular interface later than 512 bit-times into the transmission of a packet.

   **Excessive Collisions:** Number of frames for which transmission failed due to excessive collisions. Excessive collisions are defined as number of maximum collisions before the retransmission counter (defined by the truncated back-off algorithm setting according to **Back Pressure Control section**) is reset.

3. **Error Counters**

   **Receive Errors:** Counts received frames which an incorrect number of bytes.

   **Carrier Sense Errors:** Counts the number of times the carrier sense condition was lost or never asserted when attempting to transmit a frame.

   **Frame too long Errors:** Counts the number of frames that exceeded the maximum permitted frame size.

   **Frame Check Sequence Errors:** Counts the number of frames which do not pass the FCS check.

## Additional Dialogs

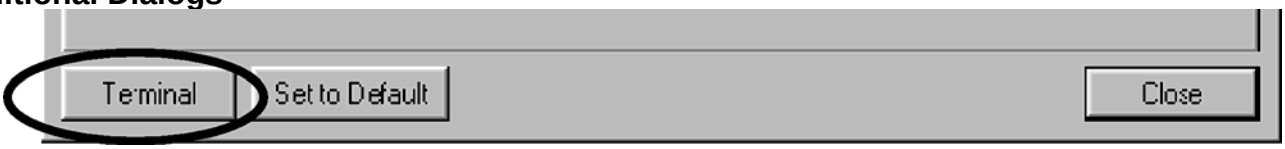



**Figure 27 Bottom Tool Bar**

## Terminal Window

The terminal window logs every access to the serial interface. The terminal window (see Figure 28) is always available and can be used to control, read and write accesses.

***Note: This feature is only recommended for the more advanced user; erroneous settings may cause malfunction of the unit***

The following functions are available within the terminal window:

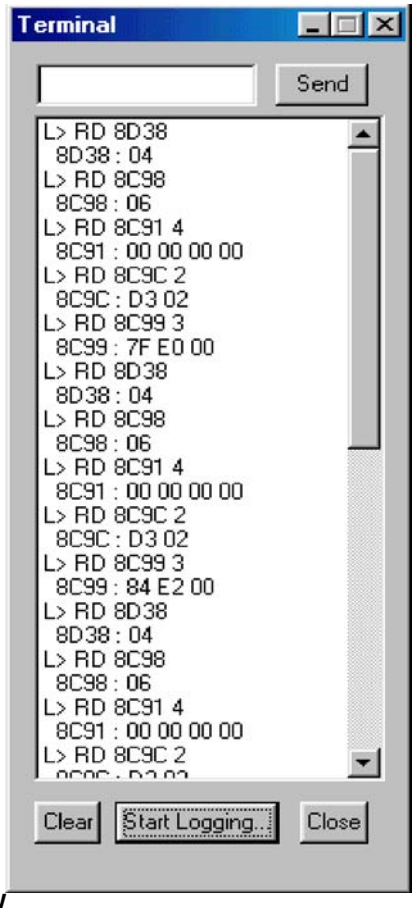



**Figure 28 Terminal Window**

**Send:** Sends the ASCII command in upper text field to the hardware. The terminal only supports the following commands (also in lower case). For some examples please refer to the **Protocol on the Serial Host Interface**.

```
RD  8 C* *
RD 8 C* **
WR  8C****
OR  8C****
ND  8C****
```

**Clear**: Clears the terminal display buffer.

**Start Logging:** Saves the current terminal session to file.

**Close:** Closes Terminal Window

**Figure 29 Bottom Tool Bar**

## Set to Default Dialog

The set-to-default dialog resets the local and the remote VDSL modem to the delivery status. This option can be used if after manual changes, problems with link synchronization occur.

***Note: If the local modem is set to default and a link is not established, the remote modem must then be connected to the VDSL Manager and a set-to-default.***

## Write-Update Message Box

When making changes to the VDSL link or to the Ethernet configuration the “Write & Update” dialog box will appear (see Figure 30)

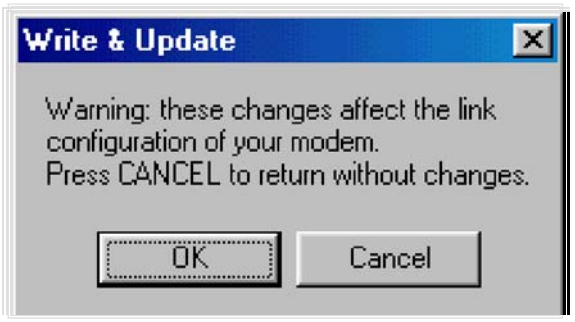

Write & Update
Warning: these changes affect the link configuration of your modem.
Press CANCEL to return without changes.
OK
Cancel

**Figure 30 Write and Update Message Box**

Pressing “OK” causes the following actions:

- If a VDSL link is established the Bridge Manager changes all registers in the remote modem (via the VOC) and then the registers in the local modem.
- If no VDSL link is established the changes are only applied to the local modem. Pressing “CANCEL” closes the box without changes.

## Error - Hardware does not respond

If on startup an error is reported by the pop up box shown in Figure 31 please proceed as follows:

1. Make sure that the serial connection between the modem and PC is OK.
2. Make sure that the modem is connected to the selected COM port (see **Startup dialog section**).
3. Press ’RETRY’

Hardware does not respond
RETRY: Retry establishing connection. Please check serial connection to the board, COM port settings and perform a hardware reset before pressing RETRY.
CANCEL: Display application dialog. No communication to board possible
Retry
Cancel

**Figure 31 Error Message - Hardware does not respond**

### Error - No answer from Remote Modem

If an error is reported as shown in Figure 32 the remote modem cannot be detected, i.e. no VDSL connection is established. Please proceed as follows:

1. Check if VDSL cable is connected properly.
2. If the cable is connected properly the local modem link configuration may be different from the remote modem link configuration.
3. Press the 'SET TO DEFAULT' button (see **Set to Default Dialog section**)
4. Connect the other VDSL Modem to the PC, restart the VDSL Bridge Manager and press the 'SET TO DEFAULT' button.
5. A VDSL link will be re-established.

**Figure 32 Error Message - No Answer from Remote Modem**

### Error - COM port not accessible

If the Bridge Manager indicates that the selected COM port is not accessible (see Figure 33) please make sure that no other application (e.g. HyperTerminal) is accessing the selected COM port. If the error message still occurs it is recommended to reboot the PC. In this case the PC resources are corrupted.

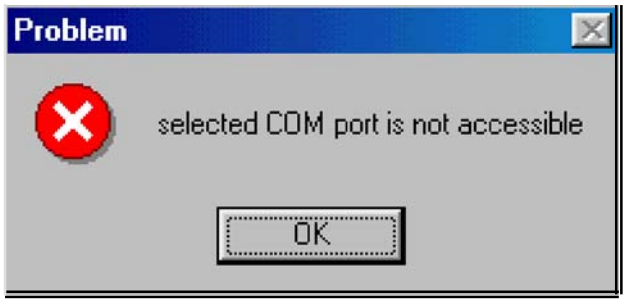



**Figure 33 Error Message - COM Port not accessible**

## CUSTOMER SERVICE

### SERVICE AND UNRESOLVED PROBLEMS

For assistance, call GDI Communications Customer Service Department between 7:00 A.M. and 3:30 P.M. Pacific Time at (775) 345-8000, FAX your request to (775) 345-8010 or email to support@sgdi.net

When calling for assistance try to do so from the installation site.
Before returning a product for repair, you must call GDI Communications's Customer Service Department and receive a Returned Material Authorization (RMA) number. This number must appear on the outside of the shipping container with the address as indicated below. Products should be returned to:

GDI COMMUNICATIONS LLC., 280 I-80 West Exit 1, Verdi NV 89439 Attention: Customer Service-RMA #

To ensure accurate return of repaired/replaced product, please enclose a note with the returned item; with your name, company name, mailing address, telephone number, RMA number and any special instructions.

During the first year after the date of purchase, all labor and materials will be provided without charge. There shall be no warranty for either parts or labor after the expiration of one year from the date of purchase or if in GDI Communications's sole discretion the product has been deemed to be modified or abused.

Units must be returned postage prepaid, CODs cannot be accepted without prior authorization from GDI Communications It is recommended that the unit be insured when shipped. Units returned without proof of date-of-purchase or out-of-warranty units will be repaired or replaced (at the option of GDI Communications) and a charge will be made for parts and labor.

Products repaired/replaced under warranty will be returned to any destination within the USA at GDI Communications's expense. GDI Communications will determine the carrier and method of shipment.

If the customer requests a specific form of conveyance or is located beyond the USA borders or if the unit is out-of-warranty, all shipping costs will be incurred by the customer.

## APPENDIX A
## SPECIFICATIONS

### CONNECTORS

LAN: Shielded or Unshielded RJ-45, 10/100Base-T, IEEE 802.3 Ethernet
VDSL: RJ 11
PHONE (POTS): RJ 11

### VDSL ENVIRONMENT

LINE: 19 to 26 AWG (0.5 mm) twisted-pair wire
LINE RATE: 1 to 25 Mbps, symmetric or asymmetric
DISTANCE: Up to 4,000 ft (1,219 m)

### LED INDICATORS

Power (Green)
Primary and Secondary Modem VDSL Sync (Green)
Primary and Secondary Modem Ethernet Good Link (Green)
Primary and Secondary Modem Activity (Yellow)
Switch Ethernet Good Link and Activity (Green)

### POWER SUPPLY

AC Power - Internal AC power, 100-240 VAC, 47-63Hz, 150 mA
DC Power - External AC power cube 90 to 240 VAC, 47 to 63Hz, 2 Watt

### OPERATING ENVIRONMENT

TEMPERATURE RANGE: -40°C to +74°C
HUMIDITY: Up to 95% non-condensing

### DIMENSIONS

3.5H x 3.8W x 5.0D in. (8.8H x 9.6W x 12.6D cm)

### MOUNTING

Metal enclosure.

## APPROVALS

## FCC NOTICE

The NT300/LT300 generates and uses radio frequency energy, and if not properly installed and used in strict accordance with the manufacturer's instructions it may cause interference to radio and television reception. The NT300/LT300 has been tested and found to comply with Class A computing device in accordance with specifications in Subpart B of Part 15 of FCC rules. However, there is no guarantee that interference will not occur in a particular installation.

**Certifications:**

- UL 60950-1: Information Technology Equipment—Safety, Part 1: General Requirements
- CAN/CSA-C22.2 (No.601.1-M90): Medical Electrical Equipment, Part 1: General Requirements for Safety and Collateral Standard: Safety Requirements for Medical Electrical Systems
- CAN/CSA-C22.2 (No.60950-1-03): Information Technology Equipment Safety, Part 1: General Requirements
- EN 55011: Conducted and Radiated Emissions
- EN 61000-3: Harmonics and Flicker
- EN 61000-4: Electrostatic Discharge, Radiated Immunity, Fast Transient Burst, Surges,
- Conducted Immunity, Power Frequency Magnetic Field, Voltage Dips and Interrupts
- EN 60950-1: Information Technology Equipment: General Requirements for Safety
- IEC 601-1/A2: Medical Electrical Equipment: General Requirements for Safety

## APPENDIX B
## FACTORY REPLACEMENT PARTS AND ACCESSORIES

### GDI Communications Model Description

| Model | Description |
|---|---|
| XC-RP300 | Hardened VDSL Repeater (without power supply) |
| XC-LT300 | Hardened VDSL Modem, voice & data |
| XC-NT300 | Hardened VDSL Modem, voice & data |
| XC300 | Hardened VDSL MODEM SET, Kit: includes one LT 300 and one NT 300, voice & data, |
| | |
| RPPS | 90-240VAC (+5V reg. DC/6A) power cube |
| NTPS | 90-240VAC (+5V reg. DC/1A) power cube |
| Console Adapter | 12” Adapter cable from Tyco 7 pin to 9 pin D Sub connector |
| IFC-VDSL/ATT | 100’ telephone line simulator |

Table 4
Replacement parts and accessories

**APPENDIX C**
**INTERFACE PIN ASSIGNMENT**

**LAN (ETHERNET 10/100BASET/TX) INTERFACE: RJ-45 UTP/STP**

(All Ethernet connectors are auto MDX.)
Pin 1: TX+
Pin 2: TX-
Pin 3: RX+
Pin 6: RX-
Pins 4, 5, 7, 8: no connection
Shield: Bat Com, Shielded Twisted Pair only (STP)

**VDSL LINE INTERFACE: RJ-11**

Pin 2: RING
Pin 3: TIP
Pins 1, 4: no connection

**PHONE (POTS/ISDN) INTERFACE: RJ-11**

Pin 2: 2-wire RING
Pin 3: 2-wire TIP
Pins 1, 4, no connection

**POWER JACK**

AC power – 3 pin IEC
DC power – Center pin: regulated +5VDC ±5%, 1.0A minimum Outer ring: Common or Ground

**CONSOLE PLUG: REAR PANEL**

Pin 2: TX
Pin 3: RX
Pin 4: GND
Pins 1, 5 - 7 no connection

**ADAPTER CABLE FOR CONSOLE WITH DB 9 PLUG:**

DB9 Connector Console connector
Pin 1: no connection
Pin 2: TX ---------- Pin 2: TX
Pin 3: RX---------- Pin 3: RX
Pin 4: no connection
Pin 5: GND ---------- Pin 4: G N D
Pins 6, 7, 8, and 9, no connection

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